

Abstract Submitted  
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**Novel Collective Excitation in Quantum Confined Pb(111) Films**

AO TENG, VAN WESEP ROBERT, The University of Tennessee, MUSTAFA ÖZER, Physics Group, Middle East Technical University, ADOLFO EGUILUZ, HANNO WEITERING, The University of Tennessee — Atomically smooth Pb(111) films were deposited on a Ge(111)-2x8 substrate and studied by high-resolution electron energy loss spectroscopy. A plasmonic feature with a positive momentum dispersion is observed at low energy, ranging in energy location from 0.3 eV in eight monolayer (ML) thin films to 1.7eV in 40 ML thick films. This excitation is no longer observable below 5 ML. Time dependent density functional theory (TDDFT) calculations of the dielectric function strongly suggest that in the bulk limit, the 1.7 eV feature can be visualized as being due to a modulation of the dielectric function by interband transitions in an otherwise simple-metal-like material. Ab initio calculations of the electronic structure within DFT have been performed to identify the specific nature of these interband transitions and their energy dependence as a function of the film thickness, from the ultrathin quantum size regime to the bulk limit.

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